NON-PUBLIC?: N
ACCESSION #: 9209220405
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Palisades Plant PAGE: 1 OF 05

DOCKET NUMBER: 05000255

TITLE: REACTOR TRIP CAUSED BY LOSS OF LOAD SIGNAL RESULTING FROM A
FAILURE OF THE TURBINE CONTROL SYSTEM
EVENT DATE: 07/01/92 LER #: 92-034-01 REPORT DATE: 09/15/92

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On July 1, 1992, at approximately 1232 hours, the plant was stable, operating at 100% power with all systems in a normal full power alignment, when the reactor automatically tripped on a loss of load signal. A turbine generator trip was generated by the turbine generator digital electrohydraulic (DEH) control system, resulting in a loss of load signal to the reactor protection system (RPS). The plant was taken to a hot shutdown condition after the event. All safety systems responded as designed. The apparent cause of the turbine generator trip was a momentary loss of power to the turbine DEH system computers which caused a turbine trip. The turbine trip resulted in a reactor trip due to loss of load. Corrective actions taken in response to the July 24, 1992 plant trip (LER 92-035) will assure that this event will not recur.

END OF ABSTRACT

EVENT DESCRIPTION

On July 1, 1992, at approximately 1232 hours, the plant was stable, operating at 100% power with all systems in a normal full power alignment, when the reactor automatically tripped on a loss of load signal. A turbine generator trip was generated by the turbine generator digital electrohydraulic (DEH) control system JJ;CPU!, resulting in a loss of load signal to the reactor protection system (RPS). The auxiliary feedwater system actuated on low levels in the steam generators as required. At 1233 hours, operations entered Emergency Operating Procedure (EOP) 1, "Post Trip Actions." At 1241 hours, EOP 1 was completed and EOP 2, "Trip Recovery" was entered which included emergency boration. The emergency boration was initiated due to the failure of Bus 1A to transfer to start-up power and the resulting loss of 2 of the 4 operating primary coolant pumps. At 1243 hours, it was noted that the nitrogen pressure in one of the safety injection tanks, T-82B, was at 178 lbs. At 1320 hours, the emergency boration was secured and EOP 2 was exited. General Operating Procedure (GOP) 3, "Hot Shutdown to Critical and Hot Standby," was entered and the plant was stable.

A post trip review was completed shortly after the event with the following observations.

The DEH display on the control room operators console did not automatically display a turbine valve status screen on the reactor trip as designed, but the alarm page display showed system actuations.

The control room annunciator chime appeared to malfunction (not sound) for several minutes after the trip. It subsequently returned to service on its own.

The critical functions monitor and control room indication responded normally following the trip. Nuclear instrumentation power range channel NI-007, which provides data logger indication, slowly dropped to zero following the reactor trip.

The 4160 VAC non-safety related Bus 1A supplying two of the four primary coolant pumps failed to transfer to start-up power from station power, resulting in loss of two primary coolant pumps.

The safety injection tank (T-82B) relief valve (RV-3128) lifted and reseated at the time of the trip which caused the low pressure

indication.

The condensate storage tank (T-2) overfilled during the event and leaked out a soft patch on an existing crack in the top of the tank.

This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv) as an event that resulted in automatic actuation of the RPS system.

CAUSE OF THE EVENT

The unit tripped as a result of a loss communication within the turbine Digital Electrohydraulic (DEH) control system which resulted in a loss of load signal being sent to the reactor protection system (RPS). The apparent cause of the DEH system failure was initially thought to be loose cable connections to the DEH data processing units. However, on July 24, 1992, a failure of the DEH system again resulted in a plant trip. Reviews of the July 24, 1992 plant trip determined that a momentary loss of power to the DEH system computers caused the plant trip. It's believed that the voltage transient observed on the 345 KV Argenta-Palisades switchyard tie line, which occurred immediately prior to the July 1, 1992 event, may have had the same effect on the DEH computers as was determined for the July 24, 1992 plant trip and is the most probable cause of the plant trip.

ANALYSIS OF THE EVENT

The DEH system was investigated by system engineering and vendor personnel. The initial most likely cause of the system failure appeared to be interconnecting cables not properly connected to the DEH system circuit boards. The latch mechanisms on these cables were not properly secured, thus the connections were loose. Loss of contact via these connectors may have occurred causing redundant Data Processing Units (DPU) 2 and 52 to simultaneously drop out and cause a turbine trip. Loss of communication from DPU 2 and 52 for four seconds will, per design, cause a turbine trip signal.

Immediately prior to the trip, (approximately 1 sec), the 345 KV Argenta-Palisades switchyard tie line tripped causing breaker cycling in the Palisades switchyard. As a result of our reviews and apparent similarities to the July 24, 1992 plant trip, we have determined that this switchyard tie line trip and breaker cycling resulted in a voltage transient that caused the DEH system to trip the turbine which resulted in the reactor trip.

The control room annunciator chime alarm sounds coincident with a light illuminating at the top of whichever control room panel has alarmed. The chime alarm and the panel light help the operator to more easily identify from which control room panel the alarm has come in on. In addition to the initial troubleshooting that was completed, long term actions are planned to investigate the failure of the chime alarm.

The nuclear instrumentation channel NI-007 plant data logger input failed to respond correctly. Control room and critical functions monitor indications were normal. It was during the post trip review that it was discovered that this channel of nuclear instrumentation had exhibited a data logger indication problem. The problem was corrected. The failure of this data logger indication had no impact on this event.

The 4160 VAC Bus 1A supplies two of the four primary coolant pumps. During check-out of the breakers that failed to transfer, it was discovered that the cubicle interlock was not properly aligned, which caused the failure to transfer. This alignment is set at the factory as part of the breaker refurbishment, but actual field conditions may exist that require this factory setting to be checked. In the future, the cubicle interlock will be adjusted as required to align with the specific cubicle the breaker is installed in. An inspection of the other breakers refurbished by the same vendor and installed during the last refueling outage was made. Four breakers were checked. Two of the breakers were re-adjusted to make the alignment better. One required no adjustment and the other one had operated satisfactory, was not safety related, and was not checked.

The safety injection tanks have a technical specification lower limit for pressure at 200 psig when the reactor is critical. When relief valve RV-3128 for safety injection tank T-82B actuated it allowed the pressure in the tank to drop to 178 lbs which is below the technical specification limit, but did not reach the limit until after the reactor was in hot shutdown. Actuation of this tank could not be totally relied upon during a required post accident scenario, but three of the four safety injection tanks are all that is needed to fulfill the safety function.

As a result of the plant trip, excess water from the main condenser was automatically rejected to the condensate storage tank. Because of the quantity of water rejected and the fact that an area on the top of the tank was lightly patched, the tank overflowed from the tank overflow and broke through the patched area also. The soft patch area was repaired and long term follow up actions will evaluate if other scenario's exist which could duplicate this event.

The turbine valve status screen did not display on the control room operators console as this screen display is generated from DPU 2 and 52, which were out of service. Corrective actions to keep the DPU units in service will also assure that this display is generated.

CORRECTIVE ACTION

A post trip review was completed in accordance with Palisades Administrative procedure 4.08, "Post Trip Review Requirements."

Prior to start-up the following actions were taken.

Vendor and maintenance personnel secured and checked all connectors on the DEH system and performed testing of the system.

SIT relief RV-3128 was repaired, tested and returned to service, and SI Tank T82B was repressurized.

The NI-007 indication was checked and its upper data-logger indication signal conditioning card was found to be defective and replaced.

Bus 1A start-up breaker was checked and found that its cubicle interlock needed adjustment. The interlock was adjusted and the breaker returned to service.

The control room annunciator chime was tested, several components of the chime replaced, and successfully tested.

The condensate storage tank (T-2) soft patch was repaired.

Longer term corrective actions have been assigned as follows to continue to review some of the conditions discovered during this plant trip.

Further reviews will be completed to investigate the root cause of the DEH data processing failures that appear to be related to the loose cable connections on the DPU units.

Other events where the possibility exists where the main condenser may reject water to the condensate storage tank will be investigated and recommendations made as appropriate to mitigate this scenario.

Further reviews will be completed to determine a root cause for the

failure of the control room annunciator chime during this reactor trip and an apparent similar occurrence from December 9, 1991.

Long term reviews and the July 24, 1992 plant trip have shown that switchyard events can adversely affect the DEH turbine control system. Corrective actions reported in LER 92-035, will assure that this condition will not recur.

ADDITIONAL INFORMATION

On July 24, 1992 the plant tripped on a loss of load signal. Subsequently LER 92-035 described that a momentary loss of power resulted in a DEH system generated turbine and subsequent plant trip. A momentary loss of power to the DEH computers has also been determined to be the cause of the July 1, 1992 plant trip.

ATTACHMENT 1 TO 9209220405 PAGE 1 OF 1

Consumers
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September 15, 1992

Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT - LICENSEE EVENT REPORT
92-034-01 - REACTOR TRIP CAUSED BY LOSS OF LOAD SIGNAL RESULTING FROM A
FAILURE OF THE TURBINE CONTROL SYSTEM - SUPPLEMENTAL REPORT

Licensee Event Report (LER) 92-034-01 is attached. This supplement changes the most probable cause of the failure of the turbine control system from loose cable connections to the data processing units, to a momentary loss of power to the control systems computers. This event was originally reported to the NRC in accordance with 10 CFR 50.73(a)(2)(iv) as an event that resulted in the automatic actuation of an engineered safety feature.

Gerald B Slade
General Manager

CC Administrator, Region III, USNRC
NRC Resident Inspector - Palisades

Attachment

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